Kober (Geo. M.)

A PLEA

FOR THE

PREVENTION OF TUBERCULOSIS.

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A PLEA FOR THE PREVENTION OF TUBERCULOSIS.

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Consumption stands first upon the list of the principal causes of death; it caused 12,059 deaths in every 100,000 from all causes during the census year (Billings[1]).

The report of our State Board of Health for the year ending June 30, 1892, shows that this disease caused 2,304 deaths, or nearly one seventh of all the deaths in an estimated population of 1,250,000.

Statistics of consumption include almost as a rule only those who die with lung manifestations, and little is said of the children and others who perish from tubercular meningitis, peritonitis, and other tubercular affections.

Tuberculosis not only leads the list of diseases in order of frequency and mortality, but the loss entailed by the long duration of the disease, and the danger to others from infection, renders the subject of grave importance from an economic as well as a medical point of view.

Whilst it is certainly true that the climate in various sections of this State exerts not only antagonistic, but also curative effects in this disease, we must remember that we have as yet a very sparsely settled State, and that certain regions in Europe, formerly exempt from the disease, have now become infected since intercourse with phthisical communities and subjects has been established.

We have invited for years the victims of consumption to breathe our pure air. In doing so we have exposed others to the ravages of a communicable disease, and it becomes our imperative duty to lessen the danger from infection, and failure to employ every known means of prevention can only be classed as criminal negligence, and I hail, therefore, with great satisfaction the resolution which declares "consumption and its allied diseases as dangerous to the public health." Whilst perhaps few medical men will be found to-day who do not believe that the disease arises either directly or indirectly from a preceding case, yet if we desire to influence legislation in matters of public health, our case should be stated on good evidence and in unmistakable terms.

In view of the importance of the subject, I have collected the following data from reliable sources regarding the contagiousness of consumption:

The classical researches of Koch[2] have established, beyond a doubt, the infectious character of tuberculosis in animals and man, whether observed in local tubercular deposits or in acute miliary tuberculosis, and that the disease is everywhere caused by a specific microbe, the bacillus tuberculosis.

This bacillus has been found in the system and in all tubercular deposits, and under a high power of the microscope may be seen to consist of small, usually curved rods, which readily undergo spore-formation. A pure cultivation of these bacilli, when introduced into the body of a healthy animal, produces the disease in question.

The tubercle bacilli have not yet been observed in the soil, water, or atmosphere. Cornet,[3] however, demonstrated their presence in the dust and on the walls of rooms inhabited by consumptives, and he, as well as Cadeac and Malet,[4] successfully inoculated the germs thus found into healthy animals.

Martin, quoted by Dr. Potter (N. Y. Medical Record, February 24, 1894), in examining the dust of one of the most frequented streets of Leipzig, found the tubercle bacillus in about 80 per cent of the specimens.

The bacilli have also been found in the *milk* of tuberculous mothers and cows, especially when the lacteal glands were the seat of the disease, or the system infected with general tuberculosis. This last remark also applies to the presence of the bacilli in the *flesh* of animals used for food; they have also been found in the *blood* of those affected with acute miliary tuberculosis, but only in limited numbers.

Villemin states that the contagious principle has also been found in the *feces*.

According to Uffelmann,[5] the tubercle bacillus is an obligate parasite which does not develop in the ordinary culture media, but is best propagated in blood serum, glycerine agar-agar, at a temperature of 99° to 100°. If the temperature is below 50° or above 108°, they cease to grow. The resistance of this germ to external influences, especially to heat and cold, is very great. Sormani[6] has shown that it requires from fifteen to twenty minutes' exposure to steam under pressure, or the same length of boiling, to destroy the vitality of the spores. This same author has demonstrated that completely dried and pulverized sputum retains its infectious character for weeks and months; and Pietro[7] asserts that tubercular matter will retain its virulence ten months after drying. Putrefaction, so destructive to many bacterial forms, exerts very little influence upon the tubercle bacilli. Sormani and Voelsch[8] claim that the vitality of the spores remained unimpaired for one hundred and eighty days in the putrefied sputum of consumptives. DeToma,[9] however, denies this, and found that putrefaction destroys the virulence of the germs after three to nine days.

Dr. Ducor, at a meeting of the Academy of Medicine in Paris (Progrès Medical, April, 1893), reported an epidemic of tuberculosis in a family which had occupied an apartment tenanted two years before by two phthisical patients. He examined pieces of wall paper from the rooms and found Koch's bacillus. Guinea-pigs inoculated with cultures from this paper died of tuberculosis. Cadeac and Bournay, in the Sem. Méd., June 14, 1893, report experiments upon dogs and pigeons which were fed with meat infected with tuberculosis. Examination of their stools revealed the presence of the bacilli, which had lost none of their virulence.

The experiments of Wesener and Falk also indicate that the bacilli resist the action of the normal gastric juice.

The experiments of Koch, Weichselbaum,[11] and others prove that artificial tuberculosis can be produced in animals by inhalation of a spray containing tubercle bacilli, by feeding animals with tuberculized food, or subjecting them to direct inoculation. Indeed, the chain of evidence is quite complete that tuberculosis is caused by the multiplication of this specific micro-organism in the tissues of the animal body, and by no other means.

In man the disease is most likely set in action by the bacilli introduced through the respiratory passages, or the digestive tract, and by

the skin and mucous membranes, especially if there be a solution of continuity; but, of course, the most frequent and dangerous mode of contracting the disease is the inhalation of the bacillus suspended in the inspired air.

The evidence as to the transmissibility of bovine tuberculosis to man has been strengthened by Demme[12], who reports four cases of intestinal tuberculosis in children, infected by the milk of a tuberculous cow, and adduces chemical and anatomical proof of his assertion. When we consider the large mortality of children under five years of age from primary tubercular ulceration of the intestines, tubercular peritonitis, and tabes mesenterica, and the fact that the food of these children consists largely of unboiled milk, we are strongly tempted to believe in the transmission of bovine tuberculosis through the milk supply.

Dr. D. E. Salmon, Chief of the Bureau of Animal Industry, in a paper read before the Pan-American Medical Congress, October 12, 1893, stated that he had no means of estimating the proportion of cases arising from infected food, but declared that tuberculosis is one of the most common diseases of milch-cows, and may affect 50, 75, or 100 per cent of the animals in large herds; the average proportion of cows affected in this country is unknown, but in dairies around our large cities from 3 to 5 per cent have been affected, when the diagnosis was made by the ordinary methods of examination. Fortunately, the milk from all tuberculous cows does not contain the bacilli, but when there are tubercles in the udder, the milk contains immense numbers of these germs. The tuberculin test is proving of immense value in the diagnosis of bovine tuberculosis, and the New York State Board of Health is killing by the hundred animals condemned by diagnoses with tuberculin. A gentleman writes to the New York "Medical Record," January 6, 1894, that his valuable herd of thoroughbred cows was twice examined by competent veterinarians, and pronounced healthy; a third examination with the aid of tuberculin caused a condemnation of over one half the herd, showing that it was impossible for the best veterinarian to discover tuberculosis by physical examination, except in extreme cases. New York, according to the "Record," evidently believes in this kind of diagnosis, and will probably have to pay $500,000 to eradicate bovine tuberculosis.

Rieck (Viertelyahrschrift für gericht med. und offentl Sanibätswesen, 1892, No. 4) reports the results of the examinations made at the Leipzig abattoir as regards tuberculosis during the years 1888 to 1891, both inclusive. During this time 67,077 cattle were slaughtered, of which 20.4 per cent were found to be tubercular.

The following illustrations of different modes of infection have been reported, viz.:

Lowenthal[13] reports the case of a woman who slept on the right side of a tuberculous husband, and contracted a conjunctivitis of the left upper eyelid, followed by enlargement and ulceration of the glands in the parotid and submaxillary region. Excision of the original deposit revealed the presence of tubercle bacilli.

Cornil and Moore[14] have shown that infection may take place through the genital mucosa, and an interesting article on chronic tubercular endometritis, referring to primary genital tuberculosis and sexual relations with tuberculous husbands, will be found in the "New York Medical Record," November 30, 1889.

Lehmann[15] reports ten cases in which the virus was transmitted by the mouth of a tuberculous Rabbi, who was in the habit of applying suction to the wound after circumcision. In these cases at the end of the second week ulcerations with a gray base were noticed at the point of infection; four of the children died shortly from tubercular meningitis; three others after a more prolonged illness; one died from diphtheria, and two recovered.

Eisenberg[16] reports a similar case, in which the sputum of the Rabbi was found to contain the bacilli. Tehernig, Pfeiffer, and Duering have reported instances of infection through the skin, in one case by means of expectorated phthisical blood, which infected a slight hand wound of a girl. Landouzy and Martin[17] have shown that inoculation of the spermatic fluid from tuberculous guinea-pigs produced the disease in one third of the animals experimented upon. This would seem to render the transmission of the disease through the sperma probable, but Gärtner (Zeitschrift für Hygiene und Infections Krunkheiten, 1893, XIII, 101) believes the direct transmission of the disease to come solely from the mother, for he found it impossible in his experiments on mice, canaries, and rabbits to obtain infected offspring when the mother was healthy, even though the semen of the father was teeming with tubercle bacilli. Under these circumstances, the disease was frequently transmitted to the generative organs of the mother, but never to the fœtus resulting from the contact.

Uffelmann believes that the secondary lesions of the alimentary tract may be produced by the patient's swallowing a portion of the expectoration. The most common source of infection of this tract, by means of unboiled milk and insufficiently cooked meat from animals affected with tuberculosis, has already been referred to. There is no evidence to show that the bacilli are transmitted in vaccination; in fact, Acker failed to discover the microbes in question in the lymph visicles of vaccinated phthisical subjects.

There is much reason for believing that the germs of the disease may be conveyed in clothing. I remember a well-authenticated instance where a perfectly healthy man bought the clothing worn by a consumptive, and contracted the disease within six months, and died from the effects two years thereafter. Perlen,[19] in his dissertation on pulmonary tuberculosis and occupation, tells us that of 4,177 tuberculous patients treated in the Munich Poliklinic, 709 were engaged in tailoring, cleansing, and shoe shops. Whilst these figures are suggestive, it is of course impossible to estimate the number of instances in which the disease was spread by dried sputum contained in clothing.

As in other infectious diseases, the question as to whether the germs are introduced *direct*, and in sufficient numbers, is of importance.

The observations of Humphrey, Pollock, and Leudet, conclusively show that in well-ventilated wards of chest and consumption hospitals, the disease is not usually found to spread.

In private practice the results are different in this respect. A French committee of investigation presents 213 cases of tuberculosis in which the communicability of the disease was clearly established. In 64 of these cases the disease was conveyed from husband to wife; in 43 from the wife to the husband; in 38 it was transmitted to brothers or sisters; in 19 from parents to the children; in 16 to distant relatives; and in 32 to outsiders. The communicability was most marked among the poorer

classes. Another collective investigation of a German medical society revealed the fact that of 938 married persons who died of acquired tuberculosis, in 101 instances either the husband or wife also contracted the disease. In 8.1 per cent of these cases the husband contracted the disease from his wife, and in 13.2 per cent the wife was infected from the husband. Other statistics might be adduced in favor of the communicability of the disease, but Zasetzky's[18] observation is of special interest. He reports the case of a tuberculous woman who married between 1872 and 1883 three husbands, all previously healthy; the first husband died in 1879 of tuberculosis, the second in 1881, and the third husband, at the time of the report in 1884, was also a victim of the disease, the wife having in the meantime died of consumption.

We can only explain the greater contagiousness in such cases by a more intimate contact, the occupation of the same room and bed, common use of eating and drinking utensils, and the vitiated air of private rooms. It is very possible that the bacilli may acquire more virulent infective powers in the foul atmosphere of overcrowded rooms, and, as suggested by Dr. Ransome, the sporulation of the bacilli may be assisted by contact with the kind of organic matter found in such atmospheres.

Since Cadeac and Malet[4] have proved that the bacilli are not contained in the breath of tuberculous patients, we must conclude that when found in the air of rooms occupied by phthisical patients, they originate from the dried sputum and other dejections on floors, walls, carpets, bedding, and clothing, which are converted into dust particles, and thus gain access into the air and the respiratory tract. The virus may also be conveyed to others, by small particles of sputum, in kissing, coughing, instrumental manipulations, or adhering to utensils in common use.

From what has been said and written on the subject, it is evident that the tubercle bacilli must be widely scattered; the modes of invasion are also numerous, and the wonder is that, relatively, only a few of those exposed to the virus actually contract the disease. This shows that invasion of these microbes is not sufficient to produce the disease, but that they must also find a susceptible subject for their proliferation and pathogenic effects, and hence *predisposition* in this as in other infectious diseases plays an important rôle.

Clinical experience indicates that faulty nutrition, bad air, lack of sunlight, debility, anæmia, mental anxiety, diabetes, whooping-cough, measles, and other diseases favor the development of tuberculosis.

The observations of Dr. Bowditch, of Boston, and Buchanan, of England, positively indicate that damp soils and habitations are predisposing causes to tuberculosis, and whilst this relation has not been satisfactorily explained, still it is possible that the bacilli of tuberculosis luxuriate best in such an atmosphere, as damp rooms are much more likely to contain an excess of organic matter. Another explanation may be found in the well-established fact that a damp air predisposes to catarrhal affections, or "colds," and these in turn may render the system more susceptible to the invasion of the tubercle bacilli. We also know that a predisposition may be *inherited*, as evidenced by a delicate physique, narrow chest, and general vulnerability of the tissues.

A vulnerability of the tissues to the disease may also be *acquired* by dust-producing occupations, and here the origin of the dust seems less important than the character of the particles which compose it. For

this reason, no doubt, the hard, sharp, and angular particles of iron and stone dust are more liable to produce lesions of the respiratory mucosa. In no other way can we explain the comparative innocuity of coal dust, the particles of which are quite free from sharp points and corners. Dr. Ogle has shown in his report—in forty-fifth annual report of the Registrar-General—that coal miners stand at the head of the list as regards freedom from phthisis and other lung diseases in dust-inhaling occupations, and that the tin miners of Cornish, who inhale a sharp, angular, and most irritant stone dust, furnish the largest number of cases. In Switzerland (Lagneau) Medical Record, March 7, 1894, 10 out of 100 stone-cutters die from phthisis, and in England 340 out of 1,000 deaths occurring among these workers were from consumption. We know, of course, that occupations involving the inhalation of an unusual amount of dust tend to produce diseases of the lungs, not necessarily tubercular, but what I wish to emphasize is, that certain dust particles are apt to cause lesions of the respiratory mucosa, and hence an increased susceptibility to the invasion of the tubercle bacilli.

It is also well known, that indoor, sedentary, and intellectual occupations predispose to the development of the disease. Of 1,000 deaths in Italy among students and seminarians, 459 died of phthisis. In England, of a like number of deaths in printers, 430 died of phthisis. Raseris' Italian Statistics show that college men and scientists generally furnish the greatest number, and sailors and tramps, the least number of victims to consumption. This indicates the value of out-door life; indeed, statistics conclusively show that it is quite exceptional for this disease to be the cause of death of those who live in the open air. In Switzerland, of 1,000 deaths occurring in out-door laborers and farmers, not more than one or two die from phthisis, and in a similar number of deaths in Italy among shepherds and farmers, only 44 to 54 died from this disease. Lagneau also tells us that the sanitary statistics from 662 towns in France show that the more the population is crowded, so in proportion are the inhabitants gravely affected with tuberculosis. Thanks to the climate of our State, we are permitted to enjoy practically an out-door life all the year around, and it is doubtless this, together with the fact that in many sections of the State, the average temperature is just suited for the performance of the physiological functions with the least possible strain upon any particular organ, which determine the remedial properties of our air. Such climatic virtues cannot fail to promote health and bodily vigor, and, therefore, a natural antagonism to disease.

Does climate afford immunity from tuberculosis? The evidence is not sufficient to show that any community in any climate is entirely free from pulmonary consumption, but we do know that whilst the mortality on the plains and in the valleys of Europe is about 3 per 1,000, and as high as 5 to 7 per 1,000 living in cities and towns, the inhabitants of certain mountainous districts, even under unfavorable sanitary surroundings, suffer to a far less extent—the mortality amounting in some localities at an elevation of 1,500 feet, to only 0.56 and 0.68 per 1,000.

Fuchs, quoted by Uffelmann, gives the following elevations as likely to afford immunity from consumption:

In the north temperate zones, at an elevation of	1,300–3,000 feet.
In the middle temperate zones, at an elevation of	2,000–5,000 feet.
In the tropical zones, at an elevation of	7,000–14,000 feet.

Bell, in speaking of our own country, refers favorably to the eastern highlands, the Alleghany region of Georgia, the Carolinas, Tennessee, Virginia, West Virginia, Pennsylvania, and the White Mountains, especially the pine forest region of the Atlantic States, from Virginia southerly, at an altitude of from 500 to 1,500 feet, and also the Pacific Coast, as notable regions for the small ratio of deaths from pulmonary diseases. In 1886 I called attention to the climate of Northern California and the infrequency of pneumonia and phthisis among the inhabitants of Modoc County, suggesting, in my concluding observations, that the great daily range of temperature, dry atmosphere, and elevation (4,700 feet), might be fatal to the development of the tubercle bacillus. (See Ninth Biennial Report of the State Board of Health, 1886.)

We have seen that the elevation affording immunity differs greatly in different zones; therefore, exemption cannot be attributed to the influence of diminished atmospheric pressure alone, although we must admit that diminished density of the air induces deeper inspirations, more effectual inflation and ventilation of the air vesicles, which naturally tend to increase the resistance of the pulmonary tissues to the invasion of the germs. It is possible that freedom from organic impurities in the air is the most important factor. Pasteur, Tyndall, and others have shown that the air of great altitudes is entirely free from organic impurities; and Miquel, Frankland, Petri, and others have examined the air for bacteria at different altitudes, and found the air at an elevation of between 6,000 and 7,000 feet to be quite free from germs.

Similar investigations have been made of the air of sea coasts and the high seas.

Uffelmann found between fifty to three hundred bacteria in one cubic meter of air on the Baltic coast, in the summer of 1887, and Moreau, Miquel, and Fisher ascertained that the sea air one hundred and twenty miles off the coast is absolutely free from bacteria. These facts throw a flood of light on Bowdin's statistics, which show that whilst the deaths from consumption in the English army were 10.7 per 1,000, the mortality in the navy was only 1.76 in 1,000 men.

PREVENTION OF TUBERCULOSIS.[20]

The facts presented in the foregoing pages justify the conclusion:

1. That tuberculosis is an infectious disease caused by a microbe, transmissible to healthy individuals under certain favorable conditions.

2. Inherited and acquired predisposition plays an important rôle in the invasion and multiplication of the bacilli.

3. The germs may enter the system by the respiratory and alimentary passages, and by the skin and mucous membranes, if there be an abrasion.

4. That whilst the bacillus has been transmitted through the milk, flesh, and blood of animals and man, the most common and effective way of distributing the disease is by the dried and pulverized sputum of tuberculous patients. Heller calculates that seven thousand two hundred million of bacilli may be expectorated in a day by a single patient.

5. The habitations of consumptives, as well as their personal effects, unless immediate disinfection has been practiced, are infected houses and objects, and liable to convey the disease to subsequent occupants.

The indications for the prevention of this disease are:

1. Notice by householders and physicians to the health authorities as soon as the disease is recognized.

2. The sputum of consumptives should be received in spitcups containing a 5-per cent solution of carbolic acid, and the contents rendered innocuous by boiling for twenty minutes. The paper and wood boxes made for this purpose should be burned. All public and private buildings should be provided with spittoons. Patients who continue out of doors should use handkerchiefs to receive their expectoration, which, if old, should be burned; at all events, linen, bedding, or clothing thus soiled should not be allowed to dry, but must be thoroughly disinfected, boiled, or steamed, and laws should be enacted against spitting into places where the sputum is liable to infect others.

3. Disinfection of all houses in which tuberculosis has occurred should be made compulsory also the disinfection of hotel rooms, sleeping car and steamer berths which have been occupied by consumptives.

4. All objects which have come in contact with consumptives should not be given away, sold, or used by others until disinfected by steam under pressure, boiling, fumigation, or a coating with lime or corrosive sublimate solution.

5. Isolation of tuberculous patients is indicated in hospitals, asylums, and prisons. In private life the patient ought to occupy a separate room and bed, use separate eating and cooking utensils, and neither receive nor give kisses, and the family physician should encourage the treatment of such cases in special hospitals.

6. Government inspection of dairies and slaughter-houses, and the extermination of bovine tuberculosis are urgently called for. In the absence of such laws, and as an additional precaution, cows' milk should be thoroughly boiled and meats well cooked.

7. A tuberculous mother should not nurse her infant, and great care must be taken in the selection of a wet nurse. Marriages with a tuberculous person should not only be discouraged, but absolutely prohibited by law.

8. Predisposed subjects should take special precautions; this is particularly true of those born of tuberculous parents, or belonging to consumptive families; those debilitated by privations or excesses, and those suffering or recovering from whooping-cough, measles, smallpox, diabetes, and catarrhal affections. Clinical experience teaches that it is quite possible to overcome this predisposition by improving the tone and general nutrition of the system. Apart from medication, careful and methodical gymnastics, attention to the skin, and other hygienic rules will prove of special value. Let us insist on the purity of the air in our houses and towns, and guard against dark, damp, and unsanitary habitations.

9. The establishment of sanitary boarding-schools in salubrious localities for children predisposed to tuberculosis, in which special attention is paid to their physical culture, appears earnestly called for, and in choosing a subsequent vocation for them, it is important to avoid occupations involving sedentary habits and indoor work, especially in a dusty atmosphere.

10. Last, but not least, the public should be educated that this fatal malady is a communicable disease, how it may be acquired and prevented, and this duty devolves not only upon the medical profession, but also upon the press, state, school, and church.

Mr. President, and members of the Sanitary Convention, I am well aware that much mental distress will be engendered by the enforcement of the rules just formulated. But the very fact that 15 per cent of the community are victims of this fatal disease, would more than justify such enlightened legislation as even the prohibition of marriages with a tuberculous person. There is entirely too much sentiment on the subject of individual rights. The annals of medicine teach us, that men and women afflicted with a communicable disease are dangerous to society, and it is the duty of the State to take what precautions it can to prevent mischief.

Legislators have a right to look to our medical societies and health departments for intelligent advice on matters affecting public health, and if a medical body recommends means for the prevention or spread of communicable diseases, they should be accepted in a practical sense and embodied in *effective* laws.

Whilst a conservative spirit should ever animate our profession, we should also possess the courage of our convictions; and yet, there are men eminent in our ranks, whilst not hesitating for a moment to urge the most heroic measures for the prevention of cholera, yellow fever, and smallpox, absolutely oppose the enforcement of efficient means for preventing the dissemination of consumption, universally admitted to be the most fatal of all communicable diseases. For my own part I fail to see the difference upon which such distinctions are based. Whilst cholera, yellow fever, and smallpox strike terror into a community, because these diseases occur in epidemics and are rapidly fatal, we know that consumption demands more victims than all these diseases combined.

The question of marriage not only involves the prevention of tuberculosis, but other communicable diseases, and no one knows better than the members of the medical profession what an excess of pain and sorrow, what an ocean of tears and blood might have been prevented, if exemption from communicable diseases in candidates for marriage were as mandatory as the question of age and race for the procurement of a license. I believe few men and women will be found unwilling to undergo an examination by their family physician for the detection of infectious diseases, the existence of which not only affects the welfare of a husband or wife, but also their offspring and the community at large, and all those who are so devoid of a feeling of responsibility as to willingly and knowingly inflict a fatal malady upon others, certainly deserve little consideration at the hands of society.

I sincerely hope that this convention will take a progressive step in a question which has occupied and cannot fail to agitate the minds of earnest men and women, and whilst we may meet with opposition, we know our cause to be just, and can confidently rely upon the intelligence and good intentions of the American people, that the cause of humanity will ultimately triumph.

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